TECHNICAL FACT SHEET 3

Multi-Service Chilled Beams

HEVAC

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Introduction

Multi-Service chilled beams (MSCBs) which are sometimes referred to as integrated service modules (ISMs) consist of either passive or active chilled beams which are factory assembled with additional building services into a single module; the services typically incorporated into MSCBs can include:

- Luminaires
- Infra-red sensors (PIR)
- Photocells
- Control valves and actuators
- Apertures for sprinkler heads
- Voice and data cabling
- Public address systems

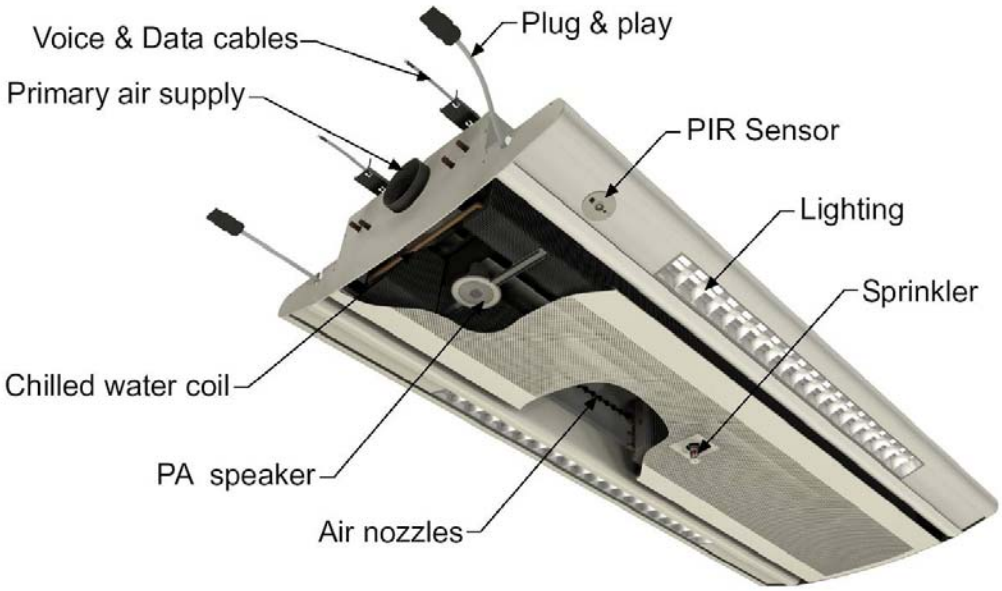

Figure 1. Typical Active Type MSCB

Integrated Luminaires

Since the 1970's codes of Interior Lighting have always recommended that designers should ensure that the lit environment achieves sufficient illumination on walls and ceilings to prevent the space appearing oppressive (for example the "Cave Effect" where the ceiling is relatively dark compared to the floor). Although this recommendation was always included it tended to be overlooked by designers, the Lighting Guide revision in 2001 (LG3) was amended to include specified lighting levels of 30% of the average working plane illuminance on the ceiling, 50% on the walls and 20% on the floor. A later amendment (LG7) solved issues found with low ceiling heights, which can be problematic in achieving the required ceiling illuminance, by allowing ceiling heights below 2.4m to have a reduced ceiling illuminance ratio of 20%.

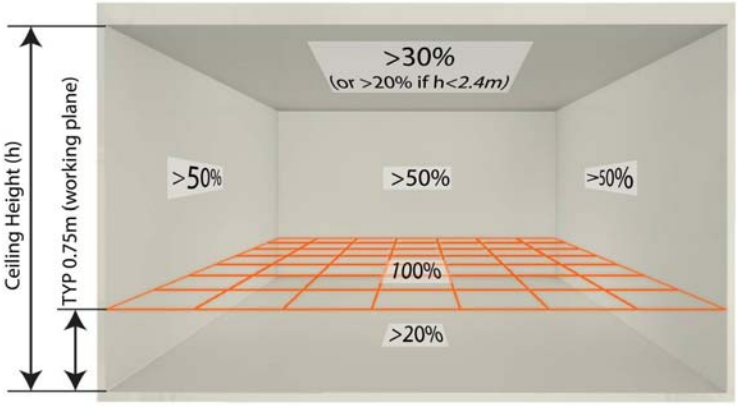

Figure 2. Lighting Guide Required Illuminance

Example: If the working plane has an average of 450 lx, then the average ceiling illuminance should achieve at least 135 lx and the average wall illuminance achieve at least 225 lx.

The most practical method to achieve the required ceiling illuminance has been to use luminaires which are hung below the ceiling / soffit that are designed to provide an amount of up-light; this however meant that the luminaires encroached down below the ceiling. The requirement for ceiling illuminance therefore has been one of the key drivers for utilising MSCB's given the common solution has been to remove the ceiling system and incorporate the direct / indirect lighting system into the exposed chilled beam.

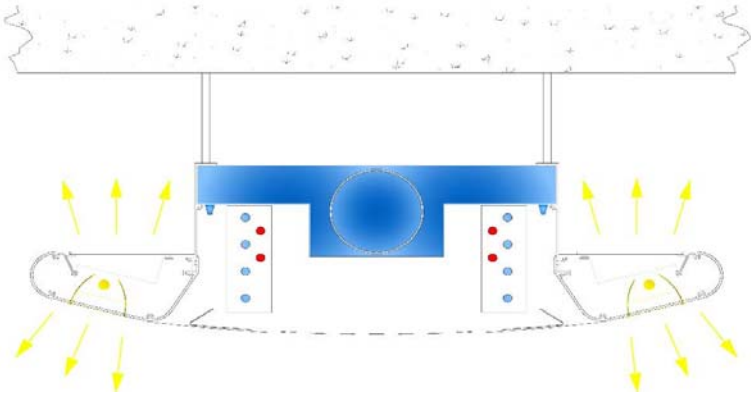

Figure 3. Typical Active MSCB Section View detailing Direct and Indirect Lighting Solution.

Although the MSCB lighting solution in some instances utilises standard luminaires simply attached to the side or centre of the chilled beam, the majority of MSCB projects utilise purpose made / designed luminaires which fully integrate into architectural side profiles and provide a superior finish and aesthetic.

It is also important to note that specially designed luminaires are tailored to provide the optimum light distribution when mounted within or on the chilled beam given every project can have slightly different height to space ratio's, thus ensuring low glare and exceptional levels of uniformity on the working plane.

Off-Site Prefabrication

The Off-Site Pre-fabrication process of MSCB's which encompass numerous building services has several key advantages namely:

- As MSCB's are assembled in a controlled factory environment it results in superior build quality and increased product accuracy compared with on site assembly / installation of different services by different trades; defects found during assembly in the factory can be remedied much more easily than on site.
- Off-Site assembly reduces the project construction time as the MSCB's can be simultaneously assembled whilst the building is in the early stages of construction and delivered to site in a "Just in Time" (JIT) programme for installation, MSCB's can be supplied "plug and play" and factory tested which reduces site based commissioning.
- Assembly in a factory environment has improved material control over that of site based work and as materials can be procured in larger quantities manufacturing efficiencies can be increased.
- Assembly in a factory environment results in increased labour productivity than site based work.
- The reduction of site based work can help on projects where either local labour is difficult to source or expensive.
- The reduction of site based operatives reduces local disruption such as noise and dust which improves site working conditions / Health and Safety.
- The use of "pre-fabrication" with factory assembly also reduces waste; as factory waste materials associated with manufacture are recycled rather than sent to site skips & landfill.

Reduced Floor to Slab Heights

The reduction in floor to ceiling height for MSCB's can also benefit new projects were traditional construction would see a finished 'slab-to-slab' height of around 3.7m. This dimension allows for a 300mm deep floor slab, 100mm floor void and a 500mm deep ceiling void for services providing a minimum 2.8m finished floor to ceiling height. So for example taking a 40 storey building would yield a building construction height of 148m ,where if MSCB's were utilised the 0.5m per floor ceiling void could be removed saving either 20m off the overall building height or allowing an extra 6 floors within the same overall construction height.

Figure 4. Building Heights and Floor Levels

Larger Spatial Perception

The use of MSCB's are perfectly suited to restricted height projects, where finished soffit heights are relatively low (for example 3.0m to 2.7m above floor level) and use of a suspended ceiling would bring down the perceived ceiling height making the installation appear oppressive; removing the suspended ceiling and utilising MSCB's results in the occupants reading the full height of the space rather than the underside of the MSCB, providing a larger volumetric perception of the space.

Fig 5. Spatial Perception

Exposed Thermal Mass

The removal of ceiling systems when utilising MSCB's can allow the designer to utilise exposed thermal mass (subject to the buildings structure) which can result in the slab absorbing energy at peak times, resulting in the system requiring less cooling. If the MSCB has a proportion of its cooling via radiant absorption then the cooling element can also have direct exchange with the warmer thermal structure which can further increase the systems effectiveness.